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REMARKS/ARGUMENTS

The amendments and remarks as presented here are believed to place the case in condition for allowance. None of the amendments made herein constitutes the addition of new matter. Accordingly, entry of these amendments, reconsideration of all pending rejections and objections, and passage to allowance is respectfully requested. This response is accompanied by a Petition for an Extension of Time and the required fees. With this response, claims 54, 69 - 90 and 96 - 108 are pending herein.

Interview with the Examiner

Examiner Alexander Noguerola's participation in a telephone interview with Stephen Barone and Sally Sullivan on January 22, 2004 is greatly appreciated. A summary of the issues discussed and arguments presented during this interview is included with this submission.

Prior to the interview, the Examiner was provided a proposed set of amended claims 54, and 69 - 95 and new claims 96 - 98. The Examiner agreed that the proposed amendments to claims 54, 69 and 81 rendered the subject matter of claims 54, and 69 - 90 patentable in view of the prior art of record. In addition, the Examiner indicated that proposed new claims 96 - 98 were allowable in the form presented during the interview. The Examiner recommended a number of amendments, however, to improve the overall clarity of claims 54, 69 and 81. All of the Examiner's suggested amendments have been adopted and, therefore, it is believed that the present application is now in condition for allowance.

Amendments to the Claims

Please cancel claims 91 - 95 with traverse.

Amendments of claims 54, 69 and 81 are requested to more particularly point out and distinctly claim the present invention. Specifically, amendment of these claims is requested to indicate that the lengths of gaps between electrodes are "larger than the sum of the lengths of diffusion layers surrounding adjacent microband electrodes formed upon establishing steady state conditions at the surface of each of said microband electrodes," and to provide that the microband electrode array sensor "generates a steady state signal equal to the sum of the signals produced by each of said microband electrodes when operated independent of said array sensor." Support for these amendments is provided by the description of preferred microband electrode array sensors having gaps between adjacent microband electrodes that "are large enough that the diffusion layers do not overlap, thereby providing for true steady-state amperometric behavior" on page 8, lines 16 - 27 and in the discussion of "additive" behavior provided on page 3, lines 25 - 29. Additional support is provided by the description of Figure 2 on page 14, lines 23 - 27, and by the discussion of exemplary embodiments on page 16, lines 22 - 25. The requested amendments to claims 54, 69 and 81 do not add any new matter.

Amendment of claim 80 is requested to change the recitation "microband electrode sensors" to recite "microband electrode array sensors." The requested amendment corrects an obvious typographical error and improves overall clarity. The requested amendment of claim 80 does not introduce any new matter.

Amendment of claim 84 is requested to change the recitation "cyclic voltammetry" to recite "stripping voltammetry." Support for amended claim 84 is provided by the description of exemplary methods of electrochemical analysis for stripping voltammetry beginning on page 23, line 25 and ending on page 25, line 7. The requested amendment of claim 84 does not introduce any new matter.

New claims 96 - 108 have been added to more particularly point out and distinctly claim the present invention. Support for new claims 96 - 108 is provided throughout the specification and as filed claims. For example, support for new claims 96 - 108 is provided by the description of preferred microband electrode array sensors on page 8, lines 16 - 27, page 13, lines 22 - 25, page 14, lines 16 - 29 and page 16, lines 21 - 30, and is provided by the description of exemplary uses of such sensors beginning on page 22, line 16 and ending on page 25, line 14. Support for new claims 103 and 104 is provided by the description of embodiments of the present invention providing a microband electrode array sensor integrated into a channel of a flow-through analysis system beginning on page 20, line 10 and ending on page 21, line 30. New claims 96 - 108 do not introduce any new matter.

Double Patenting Objections

In the pending Office Action, the Examiner advised that "should claim 83 be found allowable, claim 84 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof." Applicant has amended claim 84 such that the amended claim is now directed to methods providing stripping voltammetry measurements, rather than cyclic voltammetry measurements. Accordingly, reconsideration and withdrawal of the double patenting objection to claim 84 are respectfully requested.

Claim Rejections under 35 U.S.C. § 112

Claim 54 has been rejected under 35 U.S.C. § 112 as allegedly "indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention." Pursuant to the Examiner's recommendation, the recitation "wherein said microband electrode array sensor" has been deleted from claim 54. Therefore, reconsideration and withdrawal of the rejection of claim 54 under Section 112 are respectfully requested.

Claim Rejections under 35 U.S.C. § 103

Claims 54, 69 - 77 and 91 - 95 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Thormann *et al.* ("Voltammetry at Linear Gold and Platinum Microelectrode Arrays Produced by Lithographic Techniques," Anal. Chem. 1985, 57, 2764-2770). Claim 78 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Thormann *et al.* in view of Slater *et al.* (WO 95/10040 A1). Claims 79 and 80 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Thormann *et al.* in view of Williams *et al.* (U.S. 5,460,710). Claims 81 - 90 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Thormann *et al.* in view of Slater *et al.* (WO 95/10040 A1). Applicants respectfully traverse these rejections. To expedite prosecution and without acquiescing to these rejections, however, claims 91 - 95 are cancelled. Further, claims 54 and 69 - 90 have been amended to more clearly specify the claimed inventions. Accordingly, Applicant requests reconsideration and withdrawal of all the rejections under 35 U.S.C. § 103(a) in light of the following arguments.

Claims 54 and 69 - 90 are not made obvious by Thormann *et al.* or any of the cited combinations with Thormann *et al.* because these references do not teach, enable or suggest methods of using array sensors having comparable microband electrode dimensions and spacing that exhibit additive behavior of independent microband electrodes at steady state. Amended claims 54 and 69 - 90 are directed at methods of using an array sensor comprising a plurality of microband electrodes each having widths and thicknesses less than 25 microns that are separated by a plurality of gaps which are "each larger than the sum of the lengths of diffusion layers surrounding adjacent electrodes formed upon establishing steady state conditions at the surface of each of said microband electrodes." Therefore, amended claims 54 and 69 - 90 are expressly limited to methods wherein steady state conditions are established at the surface of each microband electrode during electrochemical analysis and the overlap of

the diffusion layers of adjacent microband electrodes is avoided during measurement. This aspect of the claimed methods is important as it provides a steady state signal of the microband electrode array sensor that is "equal to the sum of the signals produced by each of said microband electrodes when operated independent of said microband electrode array sensor."

In contrast to the inventions of the amended claims, neither Thormann *et al.* alone nor any of the cited combinations with Thormann *et al.* teach, enable or suggest electrochemical methods which provide for the combination of (1) a steady state microband electrode array measurement that exhibits (2) additive behavior of independent microband electrodes at steady state. It is therefore submitted that amended claims 54 and 69 - 90 are not rendered obvious by Thormann *et al.* or any of the cited combinations with Thormann *et al.* because their combined teachings do not teach or suggest all the limitations of the amended claims. See, e.g., In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974) & MPEP § 2143.03.

First, Thormann *et al.* alone or in the cited combinations does not teach or enable electrochemical analysis methods employing array sensors having comparable microband electrode dimensions which are capable of providing additive behavior of independent electrodes at steady state. Array I referenced in Table II of Thormann *et al.* is the only embodiment with microband electrode dimensions (width = 15 micrometers, height = 0.1 micrometers and electrode spacing = 30 micrometers) that are comparable to the inventions of amended claims 54 and 69 – 90. With respect to this embodiment, Thormann *et al.* expressly acknowledges that under their measurement and analysis conditions "[t]he three electrodes connected in parallel provide a signal that is always slightly larger than the sum of the individual currents" due to the presence of "mutual interaction between adjacent sensing elements." (page 2766, col. 2, line 25 to page 2767, col. 1, line 5). A quantitative evaluation of the data

shown in Figures 3, however, indicates that the super-additivity reported in Thormann *et al.* included deviations of about 16% when currents from individual microband electrodes are summed and compared to the current of the complete array. Contrary to the characterization by the authors, Applicants submit that this is a **substantial departure** from true additive behavior rather than a mere slight deviation.

In addition, it is unclear from the data presented in Thormann *et al.* that true additive behavior is observed even for electrode arrays having substantially larger microband electrode dimensions and electrode spacings than the inventions of amended claims 54 and 69 - 90. Although Thormann *et al.* reports that the limiting dc currents of individual sensing elements for array VI were "additive within experimental error," evaluation of the ac voltammetry data presented in Table III shows a negative deviation from expected additive behavior of approximately 18%, which is even larger than the deviation from additivity for array I shown in Figure 3. Indeed, the authors conclude their discussion of the data for array VI presented in Table III with the statement that "the important point to be established in this work is the **near additivity** of linear arrays with their individual sensing elements (Table III)." (pg. 2769, column 2, lines 14 - 16, emphasis added). Therefore, Applicants submit that it is unlikely that Thormann *et al.* discloses any electrochemical analysis methods providing true additivity of independent electrodes at steady state, regardless of electrode dimensions and electrode spacing.

Second, it is not clear that Thormann *et al.* provides any electrochemical analysis methods which provide steady-state microband electrode array measurements. Although the authors assert that their microband electrodes yield steady-state voltammetric responses, the forward and reverse traces in the cyclic voltammograms presented in Fig. 3 and Fig. 4a do not overlap and, thus, do not exhibit steady-state behavior, as understood by a person of ordinary skill in the art of electrochemistry.

Indeed, quantitative evaluation of Figs. 3 and 4a reveal substantial deviations between forward and reverse traces up to about 7%. This position is supported by the analysis provided in the declaration of Steven B. Saban and by the analysis provided by two coauthors of Thormann *et al.* (Bond and Thormann) in a later scientific reference (Bond *et al.* J. Phys. Chem. (1986), 90: 2911-2917), copies of which were provide to the Examiner with the submission of the Amendment of June 30, 2003. In contrast to the data shown in Thormann *et al.*, Figures 7, 9, 12 and 13 of the subject application clearly show that the electrochemical analysis methods of the present invention provide measurements wherein steady state conditions are established. It is therefore submitted that amended claims 54 and 69 - 90 are not rendered obvious by Thormann *et al.* or any of the cited combinations with Thormann *et al.* because their combined teachings do not teach or suggest electrochemical analysis methods capable of providing truly additive signals reflecting steady state conditions at each microband electrode.

Finally, Applicants note that Thormann *et al.* and the cited combinations with Thormann *et al.* provide no systematic studies of the effects of electrode geometry on the properties of true additivity of independent microband electrodes or additivity of microband electrodes at steady-state from which a person of ordinary skill in the art at the time of the invention could realistically arrive at the present methods providing steady state measurements exhibiting the additivity of independent electrodes at steady state. Rather, the teaching Thormann *et al.* is limited to results corresponding to a list of seven microband electrode array geometries which vary in no systematic way. Further, the seven microband electrode array geometries provided by Thormann *et al.* differ in material ways unrelated to electrode dimensions or spacing which significantly affect measurement conditions, such as the presence or absence of a chromium adhesion layer and the quality of electrode polishing. These differences preclude any meaningful comparisons. Due to the equivocal and incomplete nature of the teachings

in Thormann *et al.*, Applicants submit that submit that the reference taken alone or in the context of the cited combinations does not provide adequate teaching regarding electrochemical analysis methods to enable an artisan of ordinary skill in the art to arrive at or practice the present methods providing additivity of independent electrodes at steady state. Therefore, Applicants respectfully request reconsideration and withdrawal of all rejections based on the alleged teachings of Thormann *et al.*

Claims 78 and 81 – 90 have been rejected based on the combination of Thormann *et al.* and Slater *et al.*, and claims 79 and 80 have been rejected based on the combination of Thormann *et al.* and Williams *et al.* Slater *et al.* is characterized as teaching integration of a microband electrode array sensor into a channel and Williams *et al.* is characterized as disclosing a microband electrode array sensor having an array of sensors separated from each other by insulating material. Neither of these references cures the deficiencies of the Thormann *et al.* reference, as they do not teach electrochemical measurements capable of providing additivity of independent microband electrodes at steady state. Thus, Applicants respectfully request reconsideration and withdrawal of all rejections based on the combinations of Thormann *et al.* and Slater *et al.* or Williams *et al.*

Conclusion:

In view of the foregoing, this case is considered to be in condition for allowance and passage to issuance is respectfully requested. If new issues of patentability are raised, the Examiner is invited to call and arrange for an opportunity to discuss these issues via a phone interview.

It is believed that a one month extension is required with this submission. Therefore, a petition for a one month extension and fee of \$ 55.00 are provided. In addition a check in the amount of \$ 27.00 is provided for fees for three additional claims.

Appl. No. 09/650,075
Amdt. Dated January 26, 2004
Reply to Office Action Of September 26, 2003

If this is incorrect, please deduct the appropriate fee for this submission and any extension of time required from Deposit Account No. 07-1969.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "S. B. Barone". The signature is fluid and cursive, with the last name "Barone" being more legible than the first initials "S. B."

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Attorney Docket No. 83-96A
nk: January 26, 2004